Nonwoven fabric

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Abstract

Non-woven fabrics are produced from microfungal hyphae grown in a nutrient medium. Hyphae with branched structure are treated with alkali to expose chitin/chitosan, mixed with another fibre and formed into a wet-laid matt. The non-woven fabric can be laminated or stitch bonded with another material, or impregnated with resin, to form a variety of end products for example wound dressings, wet-pipes, or for use in capturing metallic ions.

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SPECIFICATION
Nonwoven fabric
This invention concerns the production of nonwoven fabrics from microfungal hyphae.

It has long been known that microfungal hyphae have a fibrous form. These hyphae are not very dissimilar from conventional textile fibres but they have a number of interesting characteristics including their small diameter (typically less than one fifth of that of conventional textile fibres), their branched structure (non-existent in conventional textile fibres), their tubular or hollow form (giving exceptional thermal insulation properties for example) and perhaps most importantly their unique (for a given organism and growth environment) chemical polymer structure.

Microfungal hyphae can be readily produced by fermentation in suitable nutrient solutions.

According to the present invention, there is provided a method for the production of a nonwoven fabric comprising the steps of growing a microfungal hyphae having a branched structure in a nutrient solution and which are treated with alkali to expose chitin, mixing the hyphae with another fibre, and forming a wet-laid matt from the mixture.

Preferably the hyphae are subjected to alkali treatment before being mixed with another fibre, but the mixture may be subjected to alkali treatment if desired either before or after forming the matt.

The alkali treatment dissolves protein from the outer layer of the cell walls of the hyphae to expose underlying chitin and chitosan rendering the end product particularly suitable for use in wound dressings on account of the well-known and documented accelerated wound healing properties of these substances, or for use as an ion exchange medium on account of their metallic ion capture properties.

The resulting matts, depending upon the originating organism, the added fibre and the relative portions thereof can have a desired pore size. Possible applications include use as filter media, medical and sanitary textiles for surgical dressings, tampons or the like, "wet-wipes", and as the substrate in ion exchange apparatus for metal removal and/or recovery.

The invention will be further apparent from the following examples of production of fabrics in accordance with the method of the invention, and with reference to the figures of the accompanying drawing of which: Figure 1 shows a typically branched structure of hyphae of the kind used in practising the methods of the invention; and Figure 2 is a photomicrograph of the surface of a typical fabric made in accordance with the method of the invention.

The invention is practised with microfungal hyphae having a branched structure as shown by way of example in Figure 1.

In one example micro-fungal mycelia are produced from a culture of Neurospora crassa, grown in a nutrient solution containing malt extract (17g/l) and mycological peptone (3g/l) at a temperature of 300C for one to two days.

The culture is washed and treated with a molar solution of sodium hydroxide to dissolve protein from the outer layers of the cell walls and expose the underlying chitin and chitosan.

The culture is washed again and then mixed with an equal weight of other fibre in an aqueous suspension. The mixture is subjected to mechanical agitation to ensure an even blend. The mixture is strained through a filter medium to leave a matt having a thickness of lmm or thereabouts.

The other fibre may be comprised by wood pulp, paper pulp, glass, cotton linters, polypropylene, polyester, carbon or asbestos, for example, or indeed any other natural, synthetic or mineral fibre.

The relative proportions of hyphae and fibre and the types thereof are thought to determine the pore size of the final product and the sizes possible within a useful range for filtration applications appear abundant.

In another example Neurospora crassa is replaced by Mucor mucedo.

The exposed chitin renders the fabric suitable for a number of interesting applications.

Chitin is known to accelerate the process of wound healing and a wound dressing may be formed by laminating with an absorbent backing of conventional textile material.

Chitin is also known to have the property of capture of metallic ions and sheets of the fabric may be used

as the substrate in an ion exchange apparatus for the purification of industrial effluents, including radio-active effluents by removal of toxic metal values therefrom or for recovery of precious and semi-precious metals from solution.

It will be understood that the branched structure of the hyphae contributes to a substantial interlocking of the fibres in the wet laid matt as can be seen from the photomicrograph of Figure 2 of a matt formed in accordance with the invention.

It will be appreciated that it is not intended to limit the invention to the above example only, many variations, such as might readily occur to one skilled in the art, being possible, without departing from the scope thereof.

All manner of different products can be obtained by selection of appropriate organisms and their conditions of growth, by chemical modification of the cell-wall structure of the derived hyphae, and by forming the fabrics into composites with other materials as, for example, by stitch-bonding, lamination or resin impregnation.

Any alkali treatment to dissolve protein may be effected after the hyphae have been mixed with the other fibre or even after the matt has been laid.

CLAIMS

1. A method for the production of a nonwoven fabric comprising the steps of growing microfungal hyphae having a branched structure in a nutrient solution, treating the hyphae with alkali to expose

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CLAIMS

1. A method for the production of a nonwoven fabric comprising the steps of growing microfungal hyphae having a branched structure in a nutrient solution, treating the hyphae with alkali to expose chitin chitosan, mixing the hyphae with another fibre, and forming a wet-laid matt from the mixture.

2. A method according to claim 1, in which the hyphae comprise Neurospora crassa.

3. A method according to claim 1 or claim 2, in which the hyphae comprise Mucor muceda.

4. A method according to any one of claims 1 to 3, in which the hyphae are treated with sodium hydroxide solution.

5. A method according to claim 4, in which the sodium hydroxide solution is between 0.1 and 2 molar.

6. A method according to any one of claims 1 to 5, in which the hyphae are soaked in alkali solution for a time sufficient to dissolve the protein from the outer layers of the cell walls.

7. A method according to any one of claims 1 to 6, in which the said other fibre comprises wood pulp.

8. A method according to any one of claims 1 to 7, in which the said other fibre comprises paper pulp.

9. A method according to any one of claims 1 to 8, in which the said other fibre comprises cotton linters.

10. A method according to any one of claims 1 to 9, in which the said other fibre comprises glass fibre.

11. A method according to any one of claims 1 to 10, in which the said other fibre comprises manilla hemp.

12. A method according to any one of claims 1 to 11, in which the said other fibre comprises viscose.

13. A method according to any one of claims 1 to 12, in which the said other fibre comprises polypropylene.

14. A method according to any one of claims 1 to 13, in which the said other fibre comprises polyester.

15. A method according to any one of claims 1 to 14, in which the said other fibre comprises carbon.

16. A method according to any one of claims 1 to 15, in which the said other fibre comprises asbestos.

17. A method according to any one of claims 1 to 16, in which the hyphae and the said other fibre are in the proportion 40:60 to 60:40.

18. A method according to any one of claims 1 to 17, in which the non-woven fabric is formed into a composite material.

19. A method according to claim 18, in which the non-woven fabric is laminated with another fabric.

20. A method according to claim 18, in which the non-woven fabric is stitch bonded with another material.

21. A method according to any one of claims 1 to 20, in which the non-woven fabric is resin-impregnated.

22. A method for the production of a nonwoven fabric substantially as hereinbefore described.

23. A non-woven fabric produced by a method according to any one of claims 1 to 22.

24. A non-woven fabric substantially as hereinbefore described with reference to the accompanying drawings.

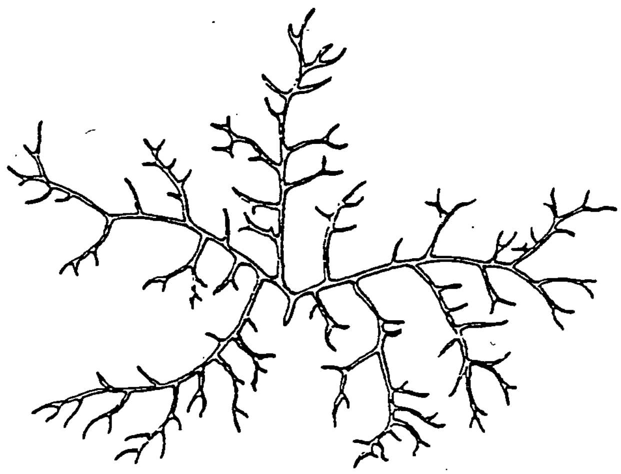

FIG.1

(x85)

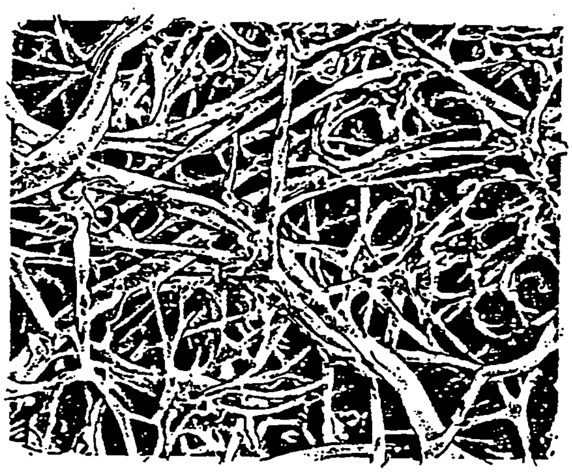

FIG.2

(x550)